

THE INVENTION CLAIMED IS:

1. A method of scheduling connections for a network processor comprising:

5 in a cache memory, scheduling a plurality of connections to be serviced based on quality of service parameters stored in a control structure corresponding to each connection; and

during a scheduling opportunity:

10 identifying one or more of the plurality of connections in the cache memory to be serviced;

selecting one of the connections identified to be serviced;

servicing the selected connection;

15 accessing one or more portions of the control structure, including the quality of service parameters, in the cache memory, the quality of service parameters corresponding to the selected connection;

20 calculating a next service time when the selected connection is to be serviced, the next service time being based on the quality of service parameters; and

determining whether to schedule the selected connection to be serviced in one of the cache memory and a calendar based on the next service time.

25 2. The method of claim 1 further comprising, during each subsequent scheduling opportunity, servicing a remaining one of the one or more connections identified to be serviced in the cache memory, until all of the one or more identified connections have been serviced.

3. The method of claim 1 wherein scheduling the plurality of connections to be serviced based on quality of

service parameters stored in the control structure
corresponding to each connection includes:

receiving data from a first connection;
determining whether an entry for a control
5 structure corresponding to the first connection is included
in one of the cache memory and an external memory;
accessing one or more portions of the control
structure;
calculating a service time when the first
10 connection is to be serviced, the service time being based
on the quality of service parameters;
determining whether to schedule the first
connection to be serviced in one of the cache memory and a
calendar based on the service time; and
15 if it is determined to schedule the first
connection in the cache memory, in the cache memory,
scheduling the first connection to be serviced based on
quality of service parameters stored in the control
structure corresponding to the first connection.

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4. The method of claim 1 wherein scheduling the
plurality of connections to be serviced based on quality of
service parameters stored in the control structure
corresponding to each connection includes storing one or
25 more portions of the control structure corresponding to each
of the plurality of connections in a cache memory entry.

5. The method of claim 1 wherein identifying one
or more of the plurality of connections in the cache memory
30 to be serviced includes employing a key to identify one or
more of the plurality of connections in the cache memory
that include a service time that matches the key, the

service time being based on the quality of service parameters.

6. The method of claim 5 further comprising
 5 scheduling the selected connection to be serviced in the cache memory when a difference between the next service time and the key is approximately less than a predetermined number of scheduling opportunities.

10 7. The method of claim 5 further comprising scheduling the selected connection to be serviced in the calendar when the difference between the next service time and the key is approximately greater or equal to than a predetermined number of scheduling opportunities.

15 8. The method of claim 1 wherein accessing one or more portions of the control structure in the cache memory includes at least one of reading from and writing to an on-chip memory.

20 9. The method of claim 1 wherein calculating the next service time when the selected connection is to be serviced includes calculating how many scheduling opportunities to wait before servicing the selected
 25 connection.

10. An apparatus for scheduling connections for a network processor comprising:
 an external memory; and
 30 scheduler logic, having a cache memory and a calendar, coupled to the external memory, and adapted to:
 in the cache memory, schedule a plurality of connections to be serviced based on quality of service

parameters stored in a control structure corresponding to each connection; and

during a scheduling opportunity:

identify one or more of the plurality of
5 connections in the cache memory to be serviced;

select one of the connections identified
to be serviced;

service the selected connection;

access one or more portions of the
10 control structure, including the quality of service
parameters, in the cache memory, the quality of service
parameters corresponding to the selected connection;

calculate a next service time when the
selected connection is to be serviced, the next service time
15 being based on the quality of service parameters; and

determine whether to schedule the
selected connection to be serviced in one of the cache
memory and the calendar based on the next service time.

20 11. The apparatus of claim 10 wherein the
scheduler logic is further adapted to, during each
subsequent scheduling opportunity, service a remaining one
of the one or more connections identified to be serviced in
the cache memory, until all of the one or more identified
25 connections have been serviced.

12. The apparatus of claim 10 wherein the
scheduler logic is further adapted to:

receive data from a first connection;

30 determine whether an entry for a control structure
corresponding to the first connection is included in one of
the cache memory and the external memory;

access one or more portions of the control structure;

calculate a service time when the first connection is to be serviced, the service time being based on the
5 quality of service parameters;

determine whether to schedule the first connection to be serviced, in one of the cache memory and the calendar based on the service time; and

if it is determined to schedule the first
10 connection in the cache memory, in the cache memory, schedule the first connection to be serviced based on quality of service parameters stored in the control structure corresponding to the first connection.

15 13. The apparatus of claim 10 wherein the scheduler logic is further adapted to store the one or more portions of the control structure corresponding to each of the plurality of connections in a cache memory entry.

20 14. The apparatus of claim 10 wherein the scheduler logic is further adapted to employ a key to identify one or more of the plurality of connections in the cache memory that include a service time that matches the key, the service time being based on the quality of service
25 parameters.

15. The apparatus of claim 14 wherein the scheduler logic is further adapted to schedule the selected connection to be serviced in the cache memory when a
30 difference between a next service time and the key time is approximately less than a predetermined number of scheduling opportunities.

16. The apparatus of claim 14 wherein the scheduler logic is further adapted to schedule the selected connection to be serviced in the calendar when a difference between a next service time and the key is approximately
 5 greater than or equal to a predetermined number of scheduling opportunities.

17. The apparatus of claim 10 wherein the scheduler logic is further adapted to at least one of read
 10 from and write to an on-chip memory.

18. The apparatus of claim 10 wherein the scheduler logic is further adapted to calculate how many scheduling opportunities to wait before servicing the
 15 selected connection.

19. The apparatus of claim 10 wherein the scheduler logic comprises:

reload control logic coupled to the cache memory,
 20 reload calendar, external memory, and evict control logic, and adapted to:

schedule one or more portions of a control structure corresponding to a connection to be serviced in the reload calendar;

25 retrieve one or more portions of the control structure corresponding to the connection to be serviced from the reload calendar; and

schedule the one or more portions of the retrieved control structure corresponding to a connection to
 30 be serviced in the cache memory;

enqueue control logic coupled to the cache memory, and the external memory, and adapted to schedule one or more

portions of the control structure corresponding to the connection to be serviced in the cache memory;

dequeue control logic coupled to the cache memory, and adapted to:

5 identify one or more of a plurality of connections in the cache memory to be serviced;

select one of the connections identified to be serviced; and

service the selected connection; and

10 evict control logic coupled to the cache memory and the external memory, and adapted to:

receive one or more portions of the control structure corresponding to the connection that was scheduled in the cache memory; and

15 determine whether to output the one or more portions of the control structure to one of the external memory and the reload control logic.

20 20. The apparatus of claim 19 wherein the cache memory includes:

a time stamp contents addressable memory;

a flow id contents addressable memory; and

a flow control block memory;

25 wherein the time stamp contents addressable memory, flow id contents addressable memory and the flow control block memory are such adapted to store one or more portions of each cache memory entry.

30 21. A method for scheduling connections comprising:

during a scheduling opportunity:

identifying one or more of a plurality of connections scheduled to be serviced in a cache memory

based on one or more portions of a control structure
corresponding to each of the plurality of connections;
servicing one of the identified connections;
and

5 scheduling the serviced connection to be
serviced again in one of the cache memory and a calendar
based on the one or more portions of the control structure
corresponding to the serviced connection.

10 22. The method of clam 21 further comprising,
during each subsequent scheduling opportunity, servicing a
remaining one of the identified connections until all of the
identified connections have been serviced.